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# Union Seniority Rules as a Determinant of Intra-Firm Job-Changes

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### Résumé de l'article

Les études d'Oison et de Berger (1982) et celles d'Abraham et de Medoff (1985) estiment que l'influence de l'effet de la compétence, dans la détermination des promotions à l'intérieur d'une entreprise syndiquée, se trouve améliorée lorsque les clauses d'une convention collective de travail stipulent qu'il faut également tenir compte de l'ancienneté comme facteur déterminant dans les promotions. Le présent article s'appuie sur les études d'Oison et de Berger (1982) en utilisant des données recueillies au niveau d'une entreprise pour observer le processus des changements d'occupation dans une entreprise déterminée, ce qui permet de nuancer la grille d'analyse de façon à y inclure tous les changements d'occupation qui peuvent se produire. Aussi, le point central de cette analyse consiste-t-il dans un examen des effets de l'ancienneté dans la caractérisation des changements d'occupation selon les modèles strictement définis : mouvements comportant une augmentation de salaire (WIM's — wage increasing moves), changement d'occupation qui a un effet positif sur le taux du salaire; mouvements neutres (WNM's — wage neutral moves), changement d'occupation sans modification du taux de salaire; mouvements décroissants du salaire (WDM's — wage decreasing moves), changement d'occupation accompagné d'un taux de salaire inférieur.

On a supposé un modèle de changement d'occupation choisi par un travailleur du rang par lequel celui-ci assume la décision de changer d'occupation uniquement si ce mouvement lui est profitable. Tous les changements d'occupation sont considérés comme des mouvements de nature à procurer des avantages. Pour estimer la probabilité d'un changement d'occupation, on a utilisé des équations de changement d'occupation de forme réduite. Le vecteur des caractéristiques personnelles comprend l'âge du travailleur, son statut matrimonial, le nombre de ses dépendants, la fréquence des accidents à son poste actuel. On y inclut ensuite à la fois l'ancienneté et l'ancienneté au carreau comme variables indépendantes.

Nous nous attendions à un rôle très marqué de l'ancienneté dans la détermination des changements d'occupation dans cette entreprise comme conséquence de l'importance de l'ancienneté dans les stipulations relatives à la fois à l'affichage des postes et aux changements d'occupation dans la convention collective de travail. On s'attendait à un coefficient positif de l'ancienneté, car les travailleurs, en obtenant la permanence, seraient plus enclins à obtenir aussi les changements d'occupation souhaités puisque l'ancienneté est un critère explicite de toute réaffectation de poste.

Tout changement d'occupation exige un investissement de ressources humaines sous forme de formation sur place; en conséquence, nous nous attendions donc à ce que l'entreprise et les travailleurs refusent un tel investissement supplémentaire à cause de l'âge des travailleurs, étant donné que le temps qui leur reste pour bénéficier des avantages va diminuant. Aussi, nous attendions-nous à un effet négatif de l'âge. Surtout, nous nous attendions à ce que à la fois l'ancienneté et l'âge soient des causes déterminantes majeures des changements d'occupation tant dans les régressions binaires que multinomiales. Nous n'avions aucune raison a priori de nous attendre à ce que l'un ou l'autre effet prédomine. Par conséquent, que l'effet d'ancienneté l'emporte sur l'effet de l'âge est une question empirique.

La source des microdonnées consiste en un échantillon du profil de 593 personnes travaillant dans un des établissements d'une entreprise industrielle qui en compte plusieurs. La main-d'œuvre est exclusivement formée de cols bleus demeurant dans une zone urbaine en Ontario. Les travailleurs sont régis par une convention collective de travail négociée par une section locale affiliée à un grand syndicat industriel américain. Il s'agit d'une firme du secteur privé qui est active dans le domaine international. Les données relatives aux travailleurs pris individuellement sont disponibles comme profils de microdonnées pour l'année 1980 et ils ont été obtenus à peu près au milieu d'une convention collective de longue durée.

L'analyse empirique commence par l'examen de la décision du travailleur de changer ou non de poste en utilisant la régression logistique à deux voies. Afin de découvrir les effets de l'ancienneté dans les promotions (WIM's), les mutations (WNM's) et les rétrogradations (WDM's), nous considérons la régression logistique des changements d'occupation selon les quatre voies que peut choisir un travailleur :

statu quo, changement d'occupation comportant soit une augmentation ou une diminution de salaire, aucune modification du salaire.

Les résultats empiriques sous-entendent que, comme échantillon moyen, l'effet de l'ancienneté l'emporte sur l'influence de l'âge tant pour les mutations (WNM's) que pour les promotions (WIM's) tel qu'on s'y attendait, étant donné le rôle marqué de l'ancienneté dans les clauses de la convention collective de travail relatives aux changements de poste. En matière d'ancienneté, les promotions (WIM's) sont concaves tandis que les mutations (WNM's) augmentent de façon linéaire pour ce qui est de l'ancienneté. Cependant, et les promotions (WIM's) et les mutations (WNM's) décroissent de façon linéaire pour l'âge. L'effet de l'âge l'emporte sur l'effet de l'ancienneté, en tant qu'échantillon moyen, en ce qui concerne les rétrogradations (WDM's). Les rétrogradations (WDM's) sont concaves en ce qui a trait à l'ancienneté et décroissent de façon linéaire en ce qui concerne l'âge. L'influence de l'ancienneté est plus grande pour les promotions (WIM's), suivie par les mutations (WNM's) et les rétrogradations (WDM's), en ordre décroissant. On pourrait développer l'analyse en obtenant des résultats de dimension longitudinale afin de vérifier l'importance progressive de l'ancienneté dans la détermination des changements d'occupation dans le temps. Malheureusement, nous ne disposons pas de données pour l'appréciation de la performance (compétence) des travailleurs. Ces données permettraient d'élargir cette étude en facilitant des vérifications directes de l'importance relative de la compétence par rapport à l'ancienneté comme critères dans les décisions portant sur les changements d'occupation.

# ***Union Seniority Rules as a Determinant of Intra-firm Job-changes***

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*Micro-data from a Canadian industrial union establishment are explored in order to ascertain the extent to which seniority rules determine job-change decisions*

In Canada, collective bargaining agreements (CBA's) frequently include provisions for seniority rules to affect such activities as promotions and transfers. If promotion is strictly governed by seniority (regardless of ability) then the firm's discretion to reward productive workers through a policy of promotion could be severely inhibited (Olson and Berger, 1982)<sup>1</sup>. Similarly, the extent to which seniority rules govern transfers may limit the firm's ability to place workers in appropriate job-types. The importance of investigating the effects of seniority are reinforced by Kochan's (1980, p. 367) observation that «despite its obvious importance and widespread use, however, the effects of seniority on the goals of individual workers, employers, and public policy objectives, has attracted almost no empirical research». This paper examines the effect of seniority rules in determining the internal mobility of workers in a blue-collar industrial union environment.

Abraham and Medoff (1985) examine the personal records of both a nonunionized and a unionized United States manufacturing firm to ascer-

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<sup>1</sup> This is especially crucial since in many collective agreements seniority is measured to the day — hence the probability of two workers having identical tenure is extremely low.

tain the relative importance of seniority and ability as factors affecting promotions in each setting. The nonunion promotion equations were estimated with a reduced form model using a logit procedure. Due to data limitations, their analysis of the union firm was restricted to descriptive statistics. Abraham and Medoff (1985, p. 414) conclude that their «... investigation of the bidding process reveals the very important role of years of service in a promotion procedure that relies on posting and bidding and is governed by a union contract», and that seniority carries a greater weight in the union promotion decision than in the nonunion promotion decision.

Olson and Berger (1982) use a panel of survey data to empirically analyse the role of seniority and human capital characteristics in determining both union and nonunion promotion decisions. They find that worker seniority is a crucial factor in determining promotions in a unionized workplace. Olson and Berger (1982) assume that all workers apply for the promotion and that the firm promotes the worker with the greatest expected value of the marginal product (subject to the CBA rules in a unionized firm). In particular, Olson and Berger (1982, p. 113) find that relative to a nonunion work environment, «... the promotion chances of an individual change when labor and management agree to language that grants seniority a role in promotions that is independent of ability.» Moreover, they note that the stronger the role given seniority, the less relevant individual ability becomes as a determinant of job-changes<sup>2</sup>. These studies imply that the role of ability in determining promotions in a unionized firm is ameliorated by contract provisions which stipulate that worker seniority also be considered as a factor.

In general, the concept of seniority rules involves offering the worker with the greatest continuous tenure the right of first refusal. The scope of seniority is defined as the individual's service within a particular «unit» of the firm; typically, a unit varies across CBA's from the departmental level to the company level as a whole<sup>3</sup>. Among collective agreements the influence of seniority in determining job-changes will vary from being a minor factor to being a primary factor, according to the language of the particular contract clause. It is useful to note that as of October 1980, in the Canadian manufacturing industry group, over 86 percent of the employees covered by CBA's covering at least 500 employees has some form of provi-

2 Specifically, OLSON and BERGER (1982, p. 122) note:

«...the change in promotion probabilities depends on the negotiated clause and on the seniority and ability of the individual. At one extreme is the pure-seniority rule under which the ability of the individual is irrelevant. At the other extreme is a pure-ability rule.»

Furthermore, they point out that many collective agreements contain clauses that correspond to intermediate cases.

3 The unit considered in determining seniority may be as disaggregated as the job-level.

sion which allowed for a role for seniority in determining promotions<sup>4</sup>. Thus seniority rules are expected to generally influence the movement of workers amongst jobs, whether or not the change in job-type involves a wage increase.

The firm in this analysis is representative of these considerations. Seniority is determined by the worker's duration of continuous service with the firm<sup>5</sup>; the unit of seniority is plant-wide. However, the collective agreement does not, in effect, distinguish between the treatment of wage neutral job-changes and wage increasing job-changes. While the distinction is recognized, both are dealt with through the mechanism of job-postings<sup>6</sup>. Once posted, a job is filled with regard to the following criteria: a) seniority of the applicant, and b) the skill, training, ability, and so forth, of the applicant, with regard to the requirements of the job-type. Workers with a wage rate equal to, less than, or greater than the wage associated with the posted job may apply for the job. Given equal skills and abilities, the firm must choose the worker with the greatest seniority<sup>7</sup>. In practice, in order to deny a job-change to a worker who has the greatest seniority, the firm must demonstrate inadequate skills, ability, and so forth on the part of the applicant. Whether or not a job-change is observed as a wage increasing move, wage neutral move or wage decreasing move is therefore determined *ex post*

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4 *Ibid.*, p. 366. The manufacturing group is the appropriate classification for the firm under study.

5 In particular, «continuous service» is defined in the collective bargaining agreement of this firm to be the duration of «uninterrupted» service since the worker last entered the employ of the firm. The criteria which determine «continuous service» will in general vary across agreements. At the firm under study, the calculation of «continuous seniority» excludes any absence from work due to a period of a strike, a layoff for a continuous period of time equal to or greater than three complete payroll periods, or a leave of absence greater than three weeks (and not due to accident, illness, or other reasons provided for in the CBA). In the empirical analysis of this study seniority is defined as the time period the worker has been employed since their date of hire.

6 In the Canadian manufacturing industry group, the major mechanism for attracting applicants to fill job vacancies is the «job-posting» procedure. See: *The Current Industrial Relations Scene in Canada 1981*, Industrial Relations Centre, Queen's University at Kingston, W.D. WOOD and P. KUMAR, Eds., p. 366.

7 The collective bargaining agreement states that the procedure for filling a job vacancy is based upon two factors: first, the applicant's seniority; second, «the requirements and efficiency of operations and the ability, knowledge, training and skill of applicants to fill the normal requirements of the job.» However, when the second factor is «... to all intents and purposes equal as between two or more employees, their relative seniority ranking shall govern...»

This rule implies that the probability of receiving a given job-change is an increasing function of seniority, *ceteris paribus*.

to the action of filling the vacancy<sup>8</sup>. However, there is no *a priori* reason to expect that the firm is unable to ever apply a «significant differences» in ability or skills criterion in order to override the seniority criterion. Therefore the extent to which seniority rules govern job-changes in practice is an empirical issue.

The major focus of the analysis is the effect of seniority in determining the probability that an individual is in one of four states, including a change of job-type with a positive wage change (WIM), a change of job-type with no change of wage rate (WNM), a change of job-type with a decrease in wage rate (WDM), and remain in the same job-type, respectively<sup>9</sup>. This analysis builds on the work of Olson and Berger (1982) by using firm-level data to examine the job-change process in a single firm. Since the data contains detailed information about worker mobility patterns, we are able to refine the scope of analysis of job-changes and the role of seniority in the unionized workplace.

## THE UNION WORKERS'S INTRA-FIRM JOB-CHANGE

We consider job-changes between job-types within one firm during the term of a collective bargaining agreement. We do not consider job-changes which involve either: a move from outside the firm to within the firm; an exit; or, a move between highly (skill or responsibility) demarcated sections of the firm's workforce (e.g., a job-change from a nonsupervisory job-type to a position with supervisory responsibilities).

8 The CBA under consideration states that the job-posting mechanism be used for all job vacancies involving job-types which provide the highest ten of twelve wage rates. Job-types associated with the two lowest wage rates are general, unskilled jobs, which are approximately comparable to each other with respect to the ability and skills required to perform such jobs. Thus job-changes from below are not a relevant consideration. However, potential wage decreasing moves into these lowest paying job-types is a consideration. An involuntary wage decreasing move (as distinct from the *ex post* definition considered in this paper) may, for example, arise when operations in a plant as a whole are curtailed, and last-in-first-out (inverse seniority) rules apply to a layoff. Workers with the lowest seniority, who hold the lowest-paying job-types, are laid off first, and the movement of workers from higher wage job-types may occur in order to meet manpower requirements in these lowest paid job-types. Under the terms of this CBA, such «bumping» is carried out on the basis of inverse seniority rules. Job-changes due to layoffs do not occur during the sample period of this analysis.

9 It is important to note that by defining the type of job-change on the basis of whether the wage rate increases, decreases or does not change, we do not follow the convention in the literature of analyzing promotions and demotions. In this analysis all job-changes are utility-improving moves. Therefore all job-changes are technically «promotions» in the sense that the worker's welfare will be improved in each of the cases we refer to as wage increasing job-changes, wage decreasing job-changes and wage neutral job-changes. Clearly, for those job-changes involving a wage decrease, we assume that nonwage job characteristics are favorable enough to result in a net improvement of worker welfare.

Generally, we assume that the change in benefits associated with any job-change  $j$  can be completely characterized by changes in nonwage characteristics,  $(\Delta\theta_j)$ , and changes in the wage rate,  $(\Delta w_j)$ . Changes in nonwage job characteristics  $(\Delta\theta_j)$  include (nonwage) pecuniary and nonpecuniary benefits and costs such as: the pension level, hours of work, shift premiums, overtime possibilities, and the risk of an accident. For simplicity we assume that workers have complete, perfect knowledge of  $\Delta w_j$  and  $\Delta\theta_j$  for all job-changes and that there are no transactions costs associated with a change of jobs.

We assume that workers have preferences defined over all job-changes and that the increment in utility of individual  $i$  for job-change  $j$  can be represented by a linearly additively separable (in each of its arguments) utility-difference function of the form:

$$\Delta U_{ij} = \Delta U_i(\Delta w_j, \Delta\theta_j) = \Delta U_i(\Delta w_j) + \Delta U_i(\Delta\theta_j) \quad (1)$$

where:  $\Delta U_{ij}$  = the change in utility of individual  $i$  resulting from job-change  $j$ .

In this analysis all job-changes are utility-improving moves<sup>10</sup>. Therefore, for wage decreasing job-changes, we assume that nonwage job characteristics are favourable enough to result in a net improvement in

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<sup>10</sup> A model put forward by ABOWD and FARBER (1982) is that the union status of a worker is a function of joining a queue for union jobs and then being selected from the queue by the employer. In the context of intra-firm job-changes one could also view workers as joining a queue by applying for a posted job and then being selected from the queue. However, the Abowd and Farber framework requires that at least one variable appear in one of their decision equations but not the other, for identification purposes. In our model it is unclear which variable to exclude. A candidate that has been suggested is the seniority of a worker. However, we believe that seniority affects both the decision to join the queue and the probability of being selected from the queue (due to the seniority clause in the CBA). A worker will have knowledge of the seniority levels of many other workers who are interested in a posted job-change. Therefore, in deciding whether or not to join the queue, workers will compare their seniority to the seniority levels of other workers who desire a job-change. Neither seniority or any other variable to which we have access can reasonably be excluded from either equation to achieve identification. Consequently, we chose to estimate a reduced form equation.

worker welfare<sup>11</sup>. Each of  $\Delta U_i(\Delta w_j)$  and  $\Delta U_i(\Delta \emptyset_j)$  are in turn a function of the worker's personal characteristics ( $X_{1ij}$  and  $X_{2ij}$  respectively) in the previous period:

$$\begin{aligned}\Delta U_i(\Delta w_j) &= X_{1ij} \cdot \beta_1 + e_{1ij} \\ \Delta U_i(\Delta \emptyset_j) &= X_{2ij} \cdot \beta_2 + e_{2ij}\end{aligned}\quad (2)$$

Here  $X_{1ij}$  and  $X_{2ij}$  are row vectors of relevant characteristics of individual  $i$  job-change  $j$  and  $e_{1ij}$  and  $e_{2ij}$  represent error terms. The error terms capture variation due to unobservable attributes of individuals and job-changes, as well as random variation of individual tastes across job-changes. The parameter vectors  $\beta_1$  and  $\beta_2$  are assumed constant across individuals and job-changes and can be interpreted as reflecting the common tastes of individuals. However due to the inclusion, in the following analysis, of the same variables in  $X_{1ij}$  and  $X_{2ij}$ , it is not possible to separately estimate all of the parameters. Consequently, upon substituting equations (2) for  $\Delta U_i(\Delta w_j)$  and  $\Delta U_i(\Delta \emptyset_j)$  in equation (1), the estimated equation is simplified to the following reduced form specification:

$$\Delta U_i(\Delta w_j, \Delta \emptyset_j) = X_{ij} \cdot \beta + \text{SEN}_i \cdot \partial + \text{SEN}_i^2 \cdot \pi + e_{ij} \quad (3)$$

where:  $\text{SEN}_i$  = seniority level of individual  $i$  and  $e_{ij} = e_{1ij} e_{2ij}$

11 The number of workers who moved to a job-type with a lower wage rate than their present job-type is 23.1 percent of all movers. This is virtually equal to the percentage of workers who made a wage neutral move (23.8 per cent) and slightly less than 1/2 the percentage of workers who made a wage increasing move (53.1 per cent). Among those movers who took a wage decreasing move, 40 percent had less than 5 years of seniority; 37 percent had between 5 and 10 years of seniority, and 23 percent had greater than 10 years of seniority (the greatest seniority level being 22.7 years). This seniority distribution of movers who accepted lower wage rates therefore represents the broad range of worker seniority expected under a worker-choice assumption. Furthermore, during the period of this analysis there were no layoffs, so that «bumping», as provided for in the CBA, is not a cause of demotions. However, we have identified three reasons why a worker could be observed to make an involuntary WDM. First, in certain operations a «force reduction» (other than layoffs) may occur in which management requires a worker to move to a new job-type at a lower wage rate; this process occurs in order of inverse seniority. Second, management may impose a WDM as a punitive action. Third, for health reasons, a worker may no longer be deemed physically capable of adequately performing their current job and be forced to make a WDM. However, we also point out that workers may file a grievance to object to an involuntary WDM.

The occurrence of WDM's among high seniority workers in our sample suggests that workers are likely to make WDM's for voluntary reasons, particularly to obtain desired non-wage job attributes (e.g., an alternative worker-supervisor relationship, opportunities for overtime, or a less hazardous work environment). We believe that there are few involuntary WDM's in our sample and that those that may occur are at the lowest seniority levels. These considerations, in addition to the accepted practice of posting for job vacancies, supports the assumption that a wage decreasing move as defined may reasonably be considered a utility-improving worker choice.

The parameter  $\beta$  is the coefficient of individual personal characteristics,  $\delta$  represents the coefficient of seniority and  $\pi$  is the coefficient of seniority-squared. The parameters may be interpreted as the utility effect of worker characteristics on a job-change. The vector  $X_{ij}$  of personal characteristics available in this analysis are worker age, seniority, seniority-squared, marital status, number of dependents, and accident frequency at their current job-type.

A positive coefficient on seniority is expected because as workers gain tenure they will be more likely to obtain their desired job-changes — since seniority is an explicit ranking criterion in CBA provisions regarding job reassignment. The seniority-squared effect is included in order to determine whether or not the seniority effect varies over time. An expectation for the sign of seniority-squared is difficult to form since the structure of the internal job hierarchy of the firm is an important factor affecting intra-firm mobility patterns. Mobility patterns depend not only on the job-change decision criteria, but also on the number of available utility-improving jobs facing each worker, relative to their present utility level. Since we do not know the configuration of the job hierarchy in terms of utility-equivalence, we have no *a priori* expectations regarding the sign of the seniority-squared coefficient.

Every job-change involves some minimal investment in human-capital for on-the-job training at the new job-type. Both the worker and firm are expected to resist the investment of resources in human capital as the worker becomes older because the time remaining in which to capture returns to the investments decreases. Therefore a negative age effect is expected for all job-changes. There are no definite *a priori* expectations associated with the signs of the coefficients for the marital status, number of dependents or number of accidents variables.

Overall, we expect both seniority and age to be important determinants of job-changes. We have no *a priori* reason to expect either effect to predominate; consequently, the relative importance of the seniority effect and the age effect is an empirical issue.

## DESCRIPTION OF THE FIRM AND DATA

The micro-data source is a cross-section sample of 593 individuals from one plant of a multi-plant Canadian industrial company. The workers are exclusively blue-collar, residing in an Ontario urban area. These workers are all covered by a collective agreement negotiated by a union local affiliated with a large international industrial union. The local bargains for



workers in the plant under study as well as for several other of the firm's plants. As such, the goals of the union local will in part reflect the goals of workers in other plants as well as those broader concerns of the international union. In turn, this is a private sector firm with international operations. The firm is also a world leader in the manufacturing industry sector.

Individual worker data are available for the year 1980, taken in the middle of a multi-year contract. The data include individual wage rate, age, seniority, marital status, number of dependents, job-type, and accident experience. There are no data on the educational attainment of individual workers. However, the workers are known to have, in general, attained no greater than a high-school education level. Moreover, the uniformly low educational levels of the workers combined with the firm's emphasis upon specific on-the-job training together imply that education is not expected to be an important determinant of advancement through the blue-collar job-types considered in this analysis<sup>12</sup>. There are no data on individual worker productivity or ability appraisals. Therefore, we cannot perform direct tests of the relative importance of ability and seniority in determining job-changes.

Given the explicit role of seniority as a determinant of job-changes, we hypothesize that the vector of all remaining personal characteristics (excluding age) represents a minor determinant of the decision to change jobs. In particular, experience is often included as a determinant of advancement. However, given that the sample consists of non-skilled workers, we do not expect pre-firm experience to be an important factor affecting intra-firm advancement. Rather, we expect experience with the present firm to be important and that this firm specific experience is captured by seniority.

Finally, using sample data from 1981, the basic job-change variable (JCHALL) was created<sup>13</sup>. This variable takes on category one if the worker changed job-type from 1980 to 1981 regardless of whether there was a change of wage rate, and category zero otherwise<sup>14</sup>. Then a refinement of the basic variable was explored. The refined job-change variable (JCH) is a discrete variable which denotes four states: state one if a job-change has occurred with no change of wage rate, state two for a change of jobs with a

12 After controlling for observed personal characteristics,  $C_o$  (in particular, seniority and age), the unobserved characteristics,  $C_u$ , will result in variations amongst individuals with similar observed characteristics. The result is a prediction bias due to these unobservables. Since the logit regressions in the following section include intercepts, we set  $E(C_u) = 0$ . We will also assume  $\text{Cov}(C_o, C_u) = 0$  and therefore interpret all estimated probabilities as unbiased.

13 An enlarged version of the data set provided the worker's wage rate and job-type for 1981, thus allowing the creation of a job-change variable.

14 The firm under consideration has approximately 90 job-types but only 12 wage rates. Thus there are many job-types which correspond to the same contract wage rates.

wage rate increase and state three for a change of jobs with a wage rate decrease. The default state is zero if there was no change of jobs. The notes to Table 1 provide specific variable definitions.

Factors such as growth in the firm's employment levels will affect job-change probabilities. For example, the expansion of operations in a plant which requires greater employment in the highest job-type (with regard to rate of pay) would increase the probability of a successful application to such jobs, over the probability facing the worker if only one such job-type has to be filled, *ceteris paribus*. However, the cross-section sample in this analysis is not subject to such employment growth during the period under consideration.

The data set possesses several further characteristics worth emphasizing. First, since we have firm-specific data, we know the precise language of the CBA clause governing job-changes, which the firm applies to each worker in the sample. This allows us to precisely characterize the seniority rule governing job-changes. Second, the data consist of a workforce in which all workers were covered by the CBA for the entire time period under consideration, as well as during the periods prior to and following 1980 (the structure of the collective bargaining framework has been stable). Third, we have a continuous measure of seniority. Therefore we know the precise seniority level of each worker in the sample. Finally, the seniority unit covers the entire plant analyzed in this study.

## EMPIRICAL ANALYSIS OF THE JOB-CHANGE EQUATIONS

The logit regression results for the basic job-change (binary logit regression) appear in the first column of Table 1. The multinomial logit regression results for WNM's, WIM's and WDM's appear in columns two, three and four, respectively, of Table 1<sup>15</sup>. The predicted probabilities of a job-change and the partial derivatives of the probabilities with respect to seniority and age are presented in Table 2 for both the binary and multinomial logit models<sup>16</sup>. The figures in Table 2, column A, are calculated for a representative individual with sample mean characteristics.

<sup>15</sup> In our utility-choice model we assume that the individual perceives each state (WNM, WIM, WDM and no job-change) as independent of each other. This corresponds to the logit model property of the independence of irrelevant alternatives. This also holds for the binary model.

<sup>16</sup> As the logit model is nonlinear, the predicted probabilities and the partial derivatives are evaluated at specific values of the explanatory variables.

## Binary Logit Results

The estimated coefficients in the JCHALL regression measure the effect of a job-change on the logarithm of the odds ratio, given a unit increase in the corresponding explanatory variable. While the estimated coefficients of the binary logit regression are difficult to interpret intuitively, they do yield qualitative information.

The expectation of a positive seniority effect in determining job-changes is a consequence of the strong role of seniority in CBA provisions regarding both job-postings and job-changes. We have no *a priori* expectations regarding the sign of the seniority-squared coefficient. The estimated coefficients for both seniority and seniority-squared are significant; the coefficients for seniority and seniority-squared are positive and negative respectively<sup>17</sup>. This implies that the logarithm of the odds ratio is concave in seniority. Loosely speaking, the likelihood that a worker changes jobs increases at a decreasing rate with seniority, reaching a maximum at 48.3 years of seniority. For seniority levels greater than 48.3 years it becomes increasingly less likely that a worker changes jobs<sup>18</sup>.

A negative age effect is expected because as a worker becomes older both the worker and firm will resist the investment of resources in human capital. The age coefficient is significant and negative, implying that workers are less likely to change jobs as they become older, *ceteris paribus*.

There were no definite *a priori* expectations associated with the signs of the coefficients for either the marital status or the number of dependents variables. The estimated coefficient of the marital status variable indicates that single workers are less likely to change jobs. The result also suggest that as the number of dependents increase a worker is less likely to change jobs. The estimated coefficient for accidents is not significantly different from zero, indicating that the number of accidents a worker experiences does not affect the likelihood of a job-change.

17 The null hypothesis that all coefficients, except the constant, are zero was rejected at a 1% level of significance, using a likelihood ratio test. Minus-two times the log-likelihood function is 304.22, which is distributed Chi-squared with 6 degrees of freedom. The null hypothesis that the seniority and seniority-squared coefficients are both equal to zero was rejected at a 1% level of significance. The Chi-squared test statistic was 26.78, which is greater than the critical value of 9.21.

18 In the sample, there are no workers with seniority greater than 45 years. The empirical result that the probability of a job-change is concave (reaching a maximum at 48.3 years of seniority) therefore implies that in practice the effect of seniority is everywhere increasing. This result suggests two possibilities: first, the seniority rule in the CBA is, in practice, enforced in a manner by which the likelihood that a worker changes jobs is everywhere increasing; second, the binary job-change classification scheme may be too general to capture variations in the effect of seniority (on the probability of a job-change) that may be observed when the job-change classification scheme used includes a four-way choice.

The predicted probability of a basic job-change (see Table 2), evaluated at the sample means of the personal characteristics, is 28 per cent for the binary model. At the sample means, a one year increase in seniority increases the probability of a job-change by 3 per cent; the net effect of increasing both age and seniority by one year is to increase the probability of a job-change by 1 per cent.

### Multinomial Logit Results

The basic job-change variable does not distinguish between the type of job-change that has occurred. That is, the basic job-change variable does not use wage rate change information. In order to more fully investigate the relationship between worker characteristics and job-changes, the basic job-change variable was refined into WNM's, WIM's and WDM's. The multinomial logit regression results appear in columns two through four of Table 1.

In a given time period, the worker is assumed to be confronted with a single four-way choice: no job-change, or a job-change involving either of a wage increase, no wage change, or a wage decrease. Aside from the increase in wage rate, a worker may wish to bid for a WIM because the new job-type has preferred nonwage job characteristics associated with it: possibly greater fringe benefits, prestige, or authority or a different probability of an accident than in the worker's present job-type. Given that the worker has the ability to perform the new job, these job characteristics are assumed to increase a worker's utility. A worker may seek a WNM or WDM (despite no wage change or a wage decrease, respectively), if preferred nonwage job characteristics are available at the new job-type. For example, new job attributes such as opportunities for overtime or shift premiums, improved social relationships with fellow workers, or a lower risk of accident, would be assumed to result in a net utility improvement for the worker<sup>19</sup>. Thus we assume that a worker's welfare is improved for each of the job-changes.

Workers are chosen on the basis of seniority when they bid for a new job-type — unless the firm is able to invoke a «significantly different skills/ability amongst applicants» criterion to override seniority rules. Consequently, we expect the seniority coefficient to be positive regardless of whether the job-change is a WNM, WIM or WDM. The seniority coefficients are significant and have the expected sign in all cases. This indicates

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<sup>19</sup> See SLICHTER, HEALY and LIVERNASH (1960, pp. 184-186) for a general discussion.

**Table 1**  
**The Job-Change Logit Regressions**

	<i>Binary Model</i>		<i>Multinomial Model</i>	
		<i>Wage Neutral Move</i>	<i>Wage Increasing Move</i>	<i>Wage Decreasing Move</i>
	$\ln\text{Prob}(JCHALL = 1)$ $\text{Prob}(JCHALL = 0)$	$\ln\text{Prob}(JCH = 1)$ $\text{Prob}(JCH = 0)$	$\ln\text{Prob}(JCH = 2)$ $\text{Prob}(JCH = 0)$	$\ln\text{Prob}(JCH = 3)$ $\text{Prob}(JCH = 0)$
CONSTANT	.9650 (.621)	-.4883 (1.16)	.1678 (.897)	-.930 (1.09)
SEN	.2752*** (.055)	.2319** (.099)	.5165*** (.107)	.2715** (.122)
SENS	-.0057*** (.001)	-.0022 (.002)	-.0181*** (.005)	-.0117** (.005)
AGE	-.1084*** (.025)	-.1125** (.046)	-.1309*** (.035)	-.0454 (.041)
SINGLE	-.6377** (.263)	-.7504 (.504)	-.6073* (.335)	-.3995 (.467)
NDEP	-.1982* (.111)	-.0958 (.189)	-.1802 (.147)	-.3228 (.230)
ACC	-.0081 (.174)	-.8658 (.573)	.1130 (.219)	.2534 (.269)
-2[Log Likelihood]	575.10		791.36	
Pseudo-R <sup>2</sup>	.53		.51	
No. of Movers	130	31	69	30
NOBS.	593		593	

1) Figures in brackets are standard errors.

2) \* Asymptotic t-ratio > 1.645.

\*\* Asymptotic t-ratio > 1.960

\*\*\* Asymptotic t-ratio > 2.576

3) The pseudo- R<sup>2</sup> measure is defined by  $1 - [L(B^H)/L(B)]$ , where  $L(B^H)$  is the log likelihood of the unconstrained model and  $L(B)$  is the log likelihood of a model including a constant(s) as the only explanatory variable.

where: AGE — worker's age in years, for 1980.

SEN — length of tenure (service) with the firm in years, for 1980.

SENS — SEN-squared.

SINGLE — 1 if single, otherwise, in 1980.

NDEP — number of dependents in 1980, including persons under 18 years of age.

ACC — number of accidents incurred on the job during 1980.

JCHALL — state 1 if job-type changed from 1980 to 1981, and state 0 otherwise,

JCH — state 1 if job-type changed from 1980 to 1981, with no change of wage rate,

— state 2 if job-type changed from 1980 to 1981, with an increase in wage rate,

— state 3 if job-type changed from 1980 to 1981, with a decrease in wage rate,

— state 0 if job-type did not change from 1980 to 1981.

**Table 2**  
**Predicted Probabilities and Partial Derivatives**

		A Evaluated at Sample Means <sup>2</sup>
<b>Binary Model<sup>1</sup></b>		
JCHALL = 1:	P'	.2842
	$\partial P / \partial \text{SEN}$	.0306
	$\partial P / \partial \text{AGE}$	-.0221
<i>Multinomial Model<sup>1</sup></i>		
Wage Neutral Move		
JCH = 1:	P'	.0438
	$\partial P / \partial \text{SEN}$	.0094
	$\partial P / \partial \text{AGE}$	-.0035
Wage Increasing Move		
JCH = 2:	P'	.1827
	$\partial P / \partial \text{SEN}$	.0275
	$\partial P / \partial \text{AGE}$	-.0181
Wage Decreasing Move		
JCH = 3	P'	.0634
	$\partial P / \partial \text{SEN}$	.0029
	$\partial P / \partial \text{AGE}$	-.0087

1) P' = Predicted probability.

2) The results in column A were evaluated at the sample means for all variables (except seniority-squared, which takes on the value of the square of the mean-seniority).

that a worker is more likely to receive the desired WNM, WIM and WDM as their seniority increases. Seniority plays the strongest role for WIM's, followed by WDM's and WNM's<sup>20</sup>.

As discussed above, we have no *a priori* expectation with respect to the sign of seniority-squared. The sign depends on a given worker's view of the structure of the internal job hierarchy of utility-improving jobs, with respect to each of WNM's, WIM's and WDM's. The estimated coefficient of seniority-squared is negative in all cases, but is significant only for job-changes involving a WIM or WDM<sup>21</sup>. Consequently, the logarithm of the

<sup>20</sup> The null hypothesis that all coefficients, except the constant, are zero was rejected at a 1% level of significance. The test statistic was 405.7, which is distributed Chi-squared with 18 degrees of freedom.

<sup>21</sup> The null hypothesis that all seniority and seniority-squared coefficients are simultaneously equal to zero was rejected at a 1% level of significance. Minus-two times the log-likelihood ratio is 54.12, which is distributed Chi-squared with 6 degrees of freedom.

odds ratio is concave in seniority for WIM's and WDM's and linearly increasing in seniority for WNM's. The likelihood that a worker makes a WIM or a WDM as seniority increases reaches a maximum at 28.5 years and 23.2 years of seniority respectively, *ceteris paribus*<sup>22</sup>.

Both the firm and the worker are expected to invest less in human capital as the worker ages, since the time remaining in which to capture returns to the investment is short. Thus we expect the age effect to decrease the likelihood of any job-change. The estimated coefficient for age is negative in all cases; however, it is significantly different from zero only for WNM's and WIM's. The negative influence of age on the likelihood of a job-change is largest for WIM's followed by WNM's and WDM's, in descending order.

With respect to WNM's (see Table 2) the predicted probability of a job-change, evaluated at the sample means, is 4 per cent. An increase in seniority of one year increases the probability of a transfer by 1 per cent. The partial derivative with respect to age, while negative, is essentially negligible so that the net effect of increasing seniority and age by one year (evaluated at the sample means), is approximately 1 per cent.

For WIM's the predicted probability of job-change is 18 per cent. The partial derivatives with respect to seniority and age are 3 per cent and -2 per cent, respectively. At the sample means, the net effect of increasing seniority and age by one year is to increase the probability of a WIM by approximately 1 per cent.

The predicted probability that a job-change will involve a WDM is 6 per cent. The effect of increasing seniority by one year is negligible. The partial derivative with respect to age is -1 per cent; thus the net effect of increasing seniority and age by one year is to decrease the probability of a WDM by approximately -1 per cent.

The empirical results suggest that (at the sample means) the seniority effect dominates the age effect for both WNM's and WIM's, as expected given the explicit role of seniority in CBA provisions regarding job-changes.

22 In the sample 10.3 percent and 16.0 percent of the workers have seniority greater than 28.5 years and 23.2 years, respectively. The multinomial results that the probability of a wage increasing move and the probability of a wage decreasing move reach a maximum in seniority at 28.5 years and 23.2 years, respectively, and that the probability of a wage neutral move is everywhere linearly increasing in seniority is in contrast to the binary regression result of a maximum probability of a job-change at 48.3 years (see footnote 16). The results of the multinomial analysis imply that a two-way classification scheme is too aggregate to capture variations in the effects of seniority on different types of job-changes; this finding suggests that researchers should, where possible, be careful to distinguish the type of job-change and level of aggregation considered.

WIM's are concave in seniority, whereas WNM's are linearly increasing in seniority. However, both WIM's and WNM's are linearly decreasing in age. Interestingly, the age effect dominates the seniority effect (at the sample means) for WDM's. WDM's are concave with respect to seniority and linearly decreasing with respect to age. The seniority effect is greatest for WIM's, followed by WNM's and WDM's, in descending order.

## CONCLUDING REMARKS

The empirical analysis suggests the presence of strong seniority rules in an industrial blue-collar work environment that has a collective agreement that specifies an explicit role for worker seniority in determining job-changes. While seniority rules were expected to be a factor in all job-changes, they empirically are found to dominate only wage increasing job-changes and wage neutral job-changes, whereas age dominates wage decreasing job-changes. The firm's apparent lack of discretion with respect to their ability to influence the allocation of workers for wage increasing job-changes and wage neutral job-changes may be crucial to its attempt to allocate its workforce efficiently.

The seniority effect dominates the age effect, at the sample means, for both wage increasing job-changes and wage neutral job-changes. Also, whereas wage increasing job-changes were found to be concave in seniority, wage neutral job-changes were found to be linearly increasing with respect to seniority. This result is consistent with behavior whereby workers, at very high levels of seniority, use their seniority to obtain wage neutral job-changes rather than wage increasing job-changes. This result is also consistent with the limited opportunities for wage increasing job-changes available to high-seniority workers — arising since the probability that they are at or near the top of the job hierarchy is high. Rather, such workers use their seniority to obtain wage neutral job-changes amongst job-types, in order to obtain jobs which have desired nonpecuniary characteristics associated with them, while retaining their present wage rate.

The analysis could be extended by providing results over a longitudinal dimension — perhaps over several contract agreements. This would allow an empirical analysis of the progressive strength of seniority upon the determination of job-changes across time, controlling for any changes in the CBA regarding the use of seniority criteria in job-changes. It would also be useful to obtain similar data for a nonunion firm, in order to directly compare the union with the nonunion wage environment. Unfortunately, we do not have data on worker performance (ability) appraisals. Such data would permit an extension of this research by allowing direct tests for the relative importance of ability versus seniority as criteria in job-change decisions.



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### ***Les règles d'ancienneté syndicales comme cause déterminante des changements d'occupation à l'intérieur d'un établissement***

Les études d'Olson et de Berger (1982) et celles d'Abraham et de Medoff (1985) estiment que l'influence de l'effet de la compétence, dans la détermination des promotions à l'intérieur d'une entreprise syndiquée, se trouve améliorée lorsque les clauses d'une convention collective de travail stipulent qu'il faut également tenir compte de l'ancienneté comme facteur déterminant dans les promotions. Le présent article s'appuie sur les études d'Olson et de Berger (1982) en utilisant des données recueillies au niveau d'une entreprise pour observer le processus des changements d'occupation dans une entreprise déterminée, ce qui permet de nuancer la grille d'analyse de façon à y inclure tous les changements d'occupation qui peuvent se produire. Aussi, le point central de cette analyse consiste-t-il dans un examen des effets de l'ancienneté dans la caractérisation des changements d'occupation selon les modèles strictement définis: mouvements comportant une augmentation de salaire (WIM's — *wage increasing moves*), changement d'occupation qui a un effet positif sur le taux du salaire; mouvements neutres (WNM's — *wage neutral moves*), changement d'occupation sans modification du taux de salaire; mouvements décroissants du salaire (WDM's — *wage decreasing moves*), changement d'occupation accompagné d'un taux de salaire inférieur.

On a supposé un modèle de changement d'occupation choisi par un travailleur du rang par lequel celui-ci assume la décision de changer d'occupation uniquement si ce mouvement lui est profitable. Tous les changements d'occupation sont considérés comme des mouvements de nature à procurer des avantages. Pour estimer la probabilité d'un changement d'occupation, on a utilisé des équations de changement d'occupation de forme réduite. Le vecteur des caractéristiques personnelles comprend l'âge du travailleur, son statut matrimonial, le nombre de ses dépendants, la fréquence des accidents à son poste actuel. On y inclut ensuite à la fois l'ancienneté et l'ancienneté au carré comme variables indépendantes.

Nous nous attendions à un rôle très marqué de l'ancienneté dans la détermination des changements d'occupation dans cette entreprise comme conséquence de l'importance de l'ancienneté dans les stipulations relatives à la fois à l'affichage des postes et aux changements d'occupation dans la convention collective de travail. On s'attendait à un coefficient positif de l'ancienneté car les travailleurs, en obtenant la permanence, seraient plus enclins à obtenir aussi les changements d'occupation souhaités puisque l'ancienneté est un critère explicite de toute réaffectation de poste.

Tout changement d'occupation exige un investissement de ressources humaines sous forme de formation sur place; en conséquence, nous nous attendions donc à ce que l'entreprise et les travailleurs refusent un tel investissement supplémentaire à cause de l'âge des travailleurs, étant donné que le temps qui leur reste pour bénéficier des avantages va diminuant. Aussi, nous attendions-nous à un effet négatif de l'âge. Sur-tout, nous nous attendions à ce que à la fois l'ancienneté et l'âge soient des causes déterminantes majeures des changements d'occupation tant dans les régressions binaires que multinomiales. Nous n'avions aucune raison *a priori* de nous attendre à ce que l'un ou l'autre effets prédominent. Par conséquent, que l'effet d'ancienneté l'emporte sur l'effet de l'âge est une question empirique.

La source des micro-données consiste en un échantillon du profil de 593 personnes travaillant dans un des établissements d'une entreprise industrielle qui en compte plusieurs. La main-d'oeuvre est exclusivement formée de cols bleus demeurant dans une zone urbaine en Ontario. Les travailleurs sont régis par une convention collective de travail négociée par une section locale affiliée à un grand syndicat industriel américain. Il s'agit d'une firme du secteur privé qui est active dans le domaine international. Les données relatives aux travailleurs pris individuellement sont disponibles comme profils de micro-données pour l'année 1980 et ils ont été obtenus à peu près au milieu d'une convention collective de longue durée.

L'analyse empirique commence par l'examen de la décision du travailleur de changer ou non de poste en utilisant la régression logistique à deux voies. Afin de découvrir les effets de l'ancienneté dans les promotions (WIM's), les mutations (WNM's) et les rétrogradations (WDM's), nous considérons la régression logistique des changements d'occupation selon les quatre voies que peut choisir un travailleur: *statu quo*, changement d'occupation comportant soit une augmentation ou une diminution de salaire, aucune modification du salaire.

Les résultats empiriques sous-entendent que, comme échantillon moyen, l'effet de l'ancienneté l'emporte sur l'influence de l'âge tant pour les mutations (WNM's) que pour les promotions (WIM's) tel qu'on s'y attendait, étant donné le rôle marqué de l'ancienneté dans les clauses de la convention collective de travail relatives aux changements de poste. En matière d'ancienneté, les promotions (WIM's) sont concaves tandis que les mutations (WNM's) augmentent de façon linéaire pour ce qui est de l'ancienneté. Cependant, et les promotions (WIM's) et les mutations (WNM's) décroissent de façon linéaire pour l'âge. L'effet de l'âge l'emporte sur l'effet de l'ancienneté, en tant qu'échantillon moyen, en ce qui concerne les rétrogradations (WDM's). Les rétrogradations (WDM's) sont concaves en ce qui a trait à l'ancienneté et décroissent de façon linéaire en ce qui concerne l'âge. L'influence de l'ancienneté est plus grande pour les promotions (WIM's), suivie par les mutations (WNM's) et les rétrogradations (WDM's), en ordre décroissant.

On pourrait développer l'analyse en obtenant des résultats de dimension longitudinale afin de vérifier l'importance progressive de l'ancienneté dans la détermination des changements d'occupation dans le temps. Malheureusement, nous ne disposons pas de données pour l'appréciation de la performance (compétence) des travailleurs. Ces données permettraient d'élargir cette étude en facilitant des vérifications directes de l'importance relative de la compétence par rapport à l'ancienneté comme critères dans les décisions portant sur les changements d'occupation.